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ABSTRACT

As part of the TV Ontario Telidon and Education Field Trials, a study was made of the application of the Telidon videotex systems to computer-assisted learning (CAL), including the future directions of these applications and differences in achievement between advanced and general-level students. Subjects were 129 middle- to upper-middle, ninth-year mathematics students in Burlington (Ontario), who used a CAL module based on the general mathematics course outlined by the Ontario Ministry of Education. Within the student sample were two control and two experimental groups, one of each in the general level and advanced level programs. Control groups received a lesson on the transformational geometry topic of dilatations through a traditional socratic method and chalkboard presentation, while the experimental groups used an individually paced module presented on the video screen. Posttest results showed little difference (2%) in achievement for the two control groups. In the experimental groups, the advanced level group was significantly superior (15%) to the general level. The teacher-led group in the general level did 12% better than the Telidon group, while the advanced level Telidon group performed 1% better on the average than the teacher-led group. (Author/LMM)

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# TELIDON AND COMPUTER ASSISTED LEARNING - a report on the first experiment using Telidon for CAL

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During November-December 1981, as part of the TV Ontario's Telidon and Education Field Trials, an educational experiment was conducted with 129 ninth year mathematics students at M.M. Robinson High School in Burlington, using a computer-assisted learning module based on the general mathematics course as outlined by the Ministry of Education in the Province of Ontario. This paper details the purpose of the experiment, a description of the student sample, the structure and design of the experiment, the selection and use of teacher aides, a brief description of the hardware and delivery system, the results of the experiment, and explores the future of videotex as applied to computer-assisted learning.

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PURPOSE

The educational experiment conducted at M.M. Robinson High School in Burlington, Ontario during November and December 1981 was an ambitious undertaking. The main purpose of the experiment was to investigate the application of the Telidon videotex system to computer-assisted learning and attempt to determine the future directions these applications may take. A secondary purpose was to investigate the differences, if any, on the learning experiences of advanced and general level students.

THE TELIDON-CAL MODULE:

The learning module was designed during the summer of 1981 based upon the Mathematics guidelines from the Ontario Ministry of Education. The topic selected was dilatations, a topic in transformational geometry which was to be considered core material for the general level mathematics students in the ninth year (first year of high school). There were several reasons for the selection of this topic:

1) it was new to the course of study and there was little material available at the proper level in printed form
2) it was a topic which could be communicated visually.
3) all students would have an equally limited background of knowledge of the topic
4) the concepts were fairly basic and easy to teach

Since NO programming language was to be used and the learning module would be a stand-alone unit, the videotex pages had to be carefully planned to respond to all possible answers. The numbering sequence of the pages of videotex allowed the students to move back and forth through the material and was an important feature of the learning module. Although the technology exists for typed responses from students using a keyboard entry system, the simple keypad system was chosen as the mode for student responses and this limited the learning module to the multiple choice presentation of material. This was considered of minor significance and did not affect the main thrust of the experiment.

In creating the pages, D. Trueman paid particular attention to the reading level of the videotex material, and the application of the Fry Test for reading level to the videotex material indicates that an average 10-11 year old could read it with little difficulty.

THE EXPERIMENT:

The control groups were given a 35 minute classroom presentation on the topic of dilatations. The lesson was based in the socratic method and a traditional chalkboard was used for illustrations. No special teaching aids or materials were used. Immediately following the presentation the same test given to the experimental groups was administered. Students were allowed 15 minutes to complete it.

The experimental groups were taken from class on an individual basis, given a brief explanation on how to operate the keypad and allowed to proceed at their own pace through the learning module presented on the video screen. Each student's response was made without prompting, direction, or assistance from the teacher-aides who supervised this part of the experiment. As each student worked through the learning module, the teacher-aide made note of the responses, the number of pages accessed, the number of wrong answers made before reaching the expected answer, and the time required to complete the learning module. After each student completed the session with the Telidon/CAL module he/she was required to complete the test designed by D. Trueman, and a questionnaire designed by the Project Evaluation Staff of TVOntario.

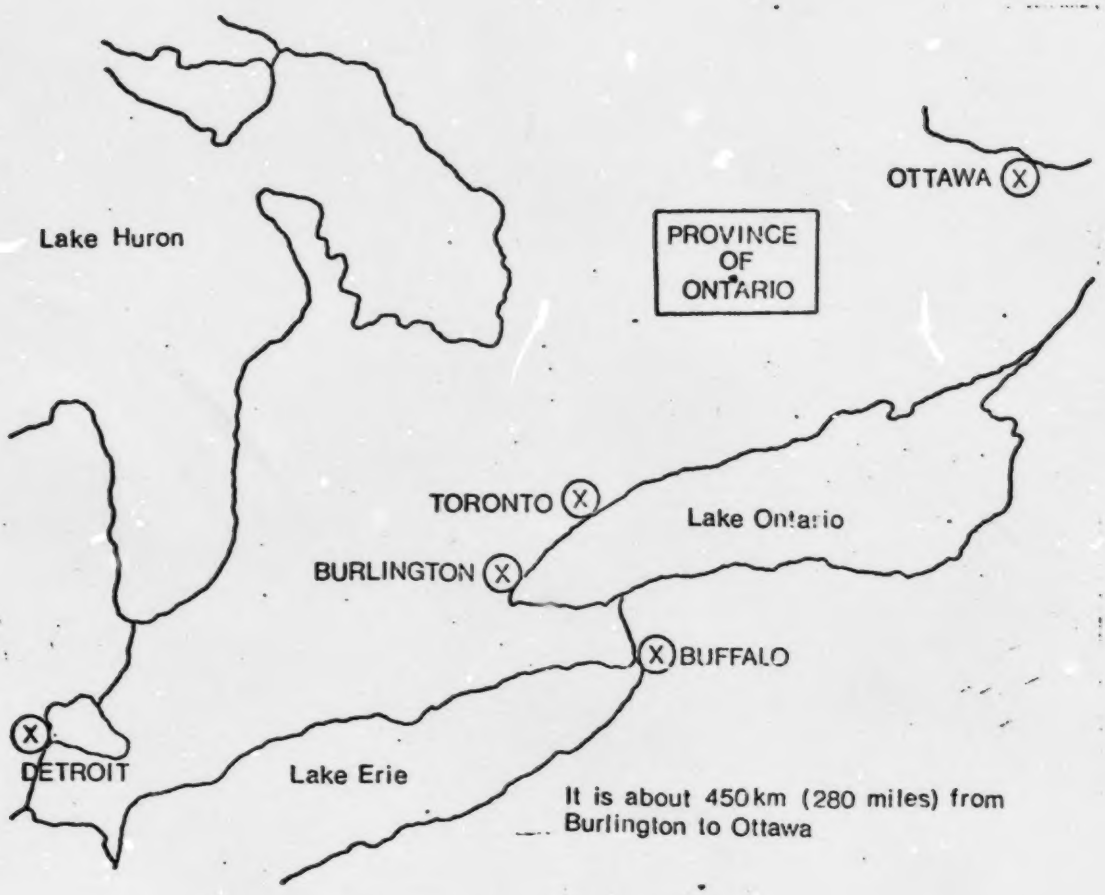
THE STUDENT SAMPLE

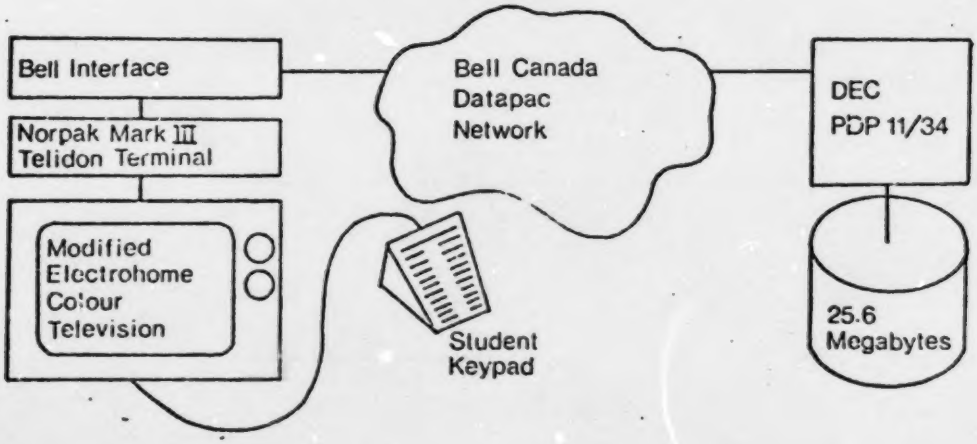
The 129 students involved in the experiment are from generally middle to upper middle class families, predominantly English-speaking Protestant, with a growing admixture of European, Asian and Caribbean backgrounds. The median age of the group at the beginning of the experiment was 14.3 years. The median reading comprehension level at the beginning of the experiment was grade 8.3. This was based on the Gates McGinnity Reading Test administered by the Halton Board of Education in April 1980. The median mathematical computation ability, based on the standardized Halton County Mathematics Test administered in May 1981 was grade 8.5. The student sample included all the students, with parental permission, enrolled in the first semester, ninth year mathematics program at M.M. Robinson High School. There were within the student sample two control groups and two experimental groups, one in each of the general level and advanced level programs.

| 2 CONTROL GROUPS | 2 EXPERIMENTAL GROUPS |
|---|---|
| -35 minutes of traditional blackboard instruction in class by the Socratic method | -no classroom instruction<br>-withdrawn from class on an individual basis |
| -no special teaching aids or materials | -"hands-on" time with the Telidon/CAL module |
| -15 minute multiple-choice test | -15 minute multiple-choice test |

THE TEACHER AIDES:
Just prior to the beginning of the experiment, senior mathematics students at M.M. Robinson High School were asked to volunteer their services as teacher aides in the supervision of the ninth year students in this educational project. Several came forward and four were selected to withdraw the individual students from class, explain the operation of the keypad, monitor the student's progress through the Telidon/CAL module, and administer the test and questionnaire. The teacher aides were chosen from the volunteers based on their knowledge of and/or experience with computers, their ability to work with younger students, and their verbal skills. Throughout the experiment they proved to be dedicated researchers making notes and concise observations, not only of the student reactions, but also of the vagaries of the equipment, the anomalies of the telidon/CAL module and the recalcitrance of the telecommunications network.

THE HARDWARE AND DELIVERY SYSTEM:
The 25.6 megabyte database was housed at Shirley Bay near Ottawa at the Canadian Research Council under the supervision of Department of Communications and mounted on a DEC PDP 11/34 with 20 ports (4 half duplex, 16 full duplex) available. Communication with the database was either by direct telephone line or through Bell Canada's Datapac Network. The videotex was delivered to the students through a Norpak Mark III Telidon Terminal using an Interface with the Bell System and a modified Electrohome Colour television set.


Lake Huron
PROVINCE OF ONTARIO
OTTAWA
TORONTO
Lake Ontario
BURLINGTON
BUFFALO
DETROIT
Lake Erie
It is about 450 km (280 miles) from Burlington to Ottawa

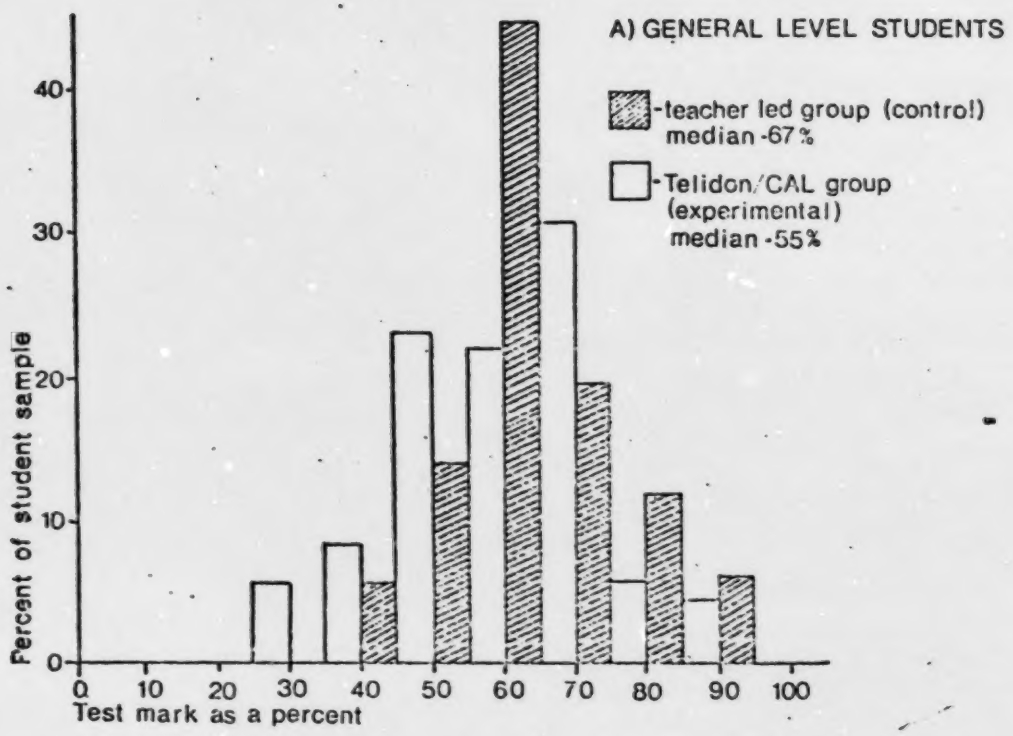

Bell Interface
Norpak Mark III Telidon Terminal
Modified Electrohome Colour Television
Bell Canada Datapac Network
Student Keypad
DEC PDP 11/34
25.6 Megabytes

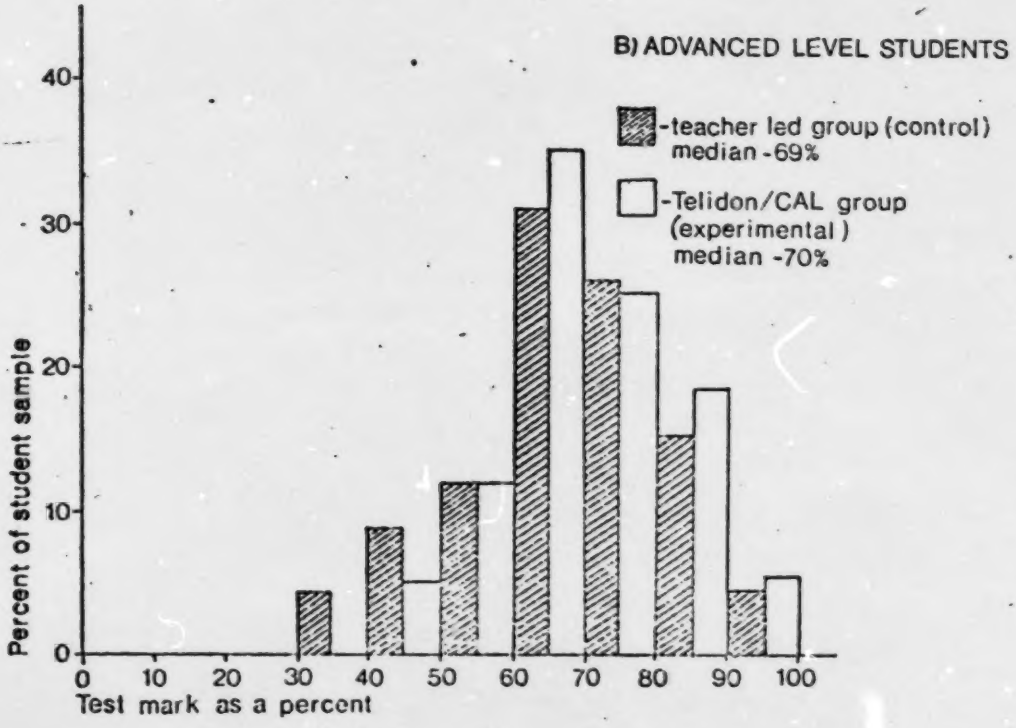
APPLICATIONS OF TELIDON TO CAL:

The Telidon videotex system is well suited to computer assisted learning. The high resolution graphics were of considerable use in the experimental module and could be used to approximate a crude form of animation. The most effective background for text was black. The text itself was fairly easy to read and, with the exception of a V and U, the alphabets were clear. The internal organization of the pages, although initially considered cumbersome, worked very well and only one student had difficulty with the page numbering system. In larger instructional units it may become difficult but, since the median time of the student sample working through the Telidon-CAL module was 33 minutes, it is unlikely that longer learning modules would be pedagogically sound from an "attention span" point of view. There were 78 pages of videotex in the experimental module. The telidon videotex system also has a great advantage, from a teacher's viewpoint, in that there is no new "language" to learn before material can be mounted on the system. A teacher-designer of a CAL program has only to lay out the concepts to be taught, consider the interactive format (multiple choice, true/false/etc.), design the pages to take care of all answers, right and wrong, number all pages and finally double check all internal page references to make sure they are correct. A flow chart is really all that is needed - no Pascal, no Fortran, no Basic!

ACHIEVEMENT ON THE TEST MODULE:

Comparing the success of the two control groups (general vs advanced levels) there was little overall difference with the advanced level achieving only 2% better than the general level on average. Both groups were taught by the same teacher. In the success of the two experimental groups (general vs advanced), however, there was a startling and significant difference with the advanced level doing 15% better, on average, than the general level. Within each level there were also some interesting results. The teacher-led (control) group in the general level did 12% better than the experimental group working independently through the Telidon/CAL module. In the advanced level, however, the teacher-led (control) group, on average, did 1% worse than the experimental group working independently through the Telidon/CAL module.


A) GENERAL LEVEL STUDENTS
-teacher led group (control)
median -67%
-Telidon/CAL group
(experimental)
median -55%
Percent of student sample
0
10
20
30
40
0 10 20 30 40 50 60 70 80 90 100
Test mark as a percent


B) ADVANCED LEVEL STUDENTS
-teacher led group (control)
median -69%
-Telidon/CAL group
(experimental)
median -70%
Percent of student sample
0
10
20
30
40
0 10 20 30 40 50 60 70 80 90 100
Test mark as a percent

CONCLUSIONS:

A) IMPACT ON THE LEARNING EXPERIENCES OF GENERAL LEVEL STUDENTS:

Students in this group generally exhibit average to below average mathematical abilities. The attitude of students of this ability level toward learning in general and innovation in particular is, in the main, unenthusiastic. A considerable amount of student concern centered around their ability to "handle" the machinery and/or the mathematical concepts presented. When technical problems with the system did occur, this group became easily discouraged. Based on the common test, the teacher-led (control) group achieved a greater understanding of the material than the Telidon/CAL (experimental) group. This result indicates that presentation of NEW material to students in the general level is better done by a teacher. Although much more experimentation is required in this area, the most appropriate application of Telidon/CAL programmes for these students may well be drill, reinforcement, remediation, etc.

B) IMPACT ON THE LEARNING EXPERIENCES OF ADVANCED LEVEL STUDENTS:

Students in this group generally exhibit average to above average mathematical abilities. The attitude of this ability level toward learning is usually positive and they display a fair degree of curiosity. When technical problems with the system occurred, this group exercised considerable patience and very few showed signs of serious frustration. Based on the common test, the Telidon/CAL (experimental) group achieved a slightly greater understanding of the material than the teacher-led (control) group. This result indicates that presentation of new material to students in the advanced level may be done equally well by a teacher or Telidon/CAL. Although much more experimentation is required in this area, Telidon/CAL programs designed to introduce new material would be most effective if directed toward the advanced level student. At present, this system shows great promise for encouraging more information providers to become actively involved in the development of CAL programs using videotex.

FUTURE APPLICATIONS:

The initial development of videotex and CAL will probably be in the private sector. Because of the simplicity of

"programming", large corporations may find it cheaper to retrain or update employees via in-house designed videotex programs rather than by sending them to seminars, workshops, etc. The large multi-national computer companies already have developed, at considerable expense, in-house CAL programs. The most exciting long term prospect for Telidon in the CAL field is the restructuring of the education system which will occur ultimately because of the rapidly escalating labour costs, declining enrollment, and a shift in public priorities away from education. With increasing costs and decreasing public support, however, will come a paradoxical increase in demand for education as more and more people discover that their jobs have vanished or drastically changed and they must re-educate themselves to find new employment. This set of circumstances could well lead to the development of unstructured community learning centres organized initially around public library systems. The use of computer-assisted learning modules, using a videotex format in such a setting, would allow a person to tailor his education to his goals as he progresses through life and the concept of school as a place for people between the ages of 6 and 18 would become obsolete. The increasing numbers of people attending continuing education classes is a harbinger of this new age. The development of effective and widely used Telidon/CAL modules designed and structured according to defined pedagogical models will be done best by creative and innovative professional teachers. Then the manufacture of low cost hardware and courseware will allow the industry to penetrate the home market, where the demand for CAL will build as a spin-off of the burgeoning electronic video game market. Videotex will play an important role in the development of new learning strategies required to satisfy these increasingly disaggregated demands.

What <u>is</u> on the horizon?
- one word or short phrase responses to Telidon/CAL modules?
- user manipulation of data in a way similar to video games
- Key word search techniques?
- down-loading of programs to the user's Telidon terminal?
- micro-computer interfaces?
- some surprises?

In such a rapidly changing industry the future of videotex in general, and Telidon/CAL in particular, is bright.